

## ENVIRONMENTAL EDUCATION

### BIOLOGICAL RESOURCES AND DEVELOPMENT

[Professor Ivica T. Radovic](#)

Faculty of Biology, University of Belgrade

Yugoslavia

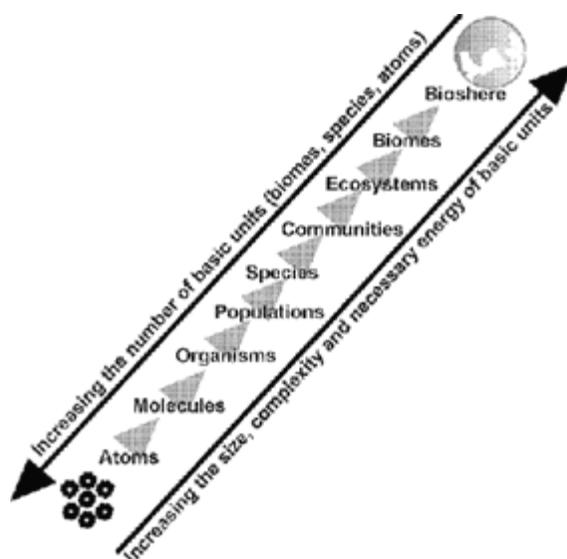
Man is a unique species, and one which possesses the ability to learn and adjust his behaviour accordingly. Education, therefore, plays an important part in human survival. Considering the fact that environmental education represents a focal point for many international conferences, scientific meetings and agreements around the world, the principal aim of this paper is to draw attention, once more, to the importance of environmental education for global environmental protection.

Education, including formal education, public awareness and training, should be recognised as a process by which human beings and societies can reach their fullest potential. Education is critical for promoting sustainable development and improving the capacity of people to address environmental and development issues. The main objective of this paper is to attempt to answer six questions concerning environmental education, with particular reference to the system of environmental education at the University of Belgrade Faculty of Biology.

1. What are the objectives of environmental education?
2. What is the significance of environmental education?
3. Who are the members of the target groups for environmental education?
4. How should environmental education be organised, particularly concerning the university level?
5. What are biological resources and what is the significance of biodiversity?
6. How can the biocentric approach aid environmental education and the future development of sustainability?

#### Objectives of environmental education

One of the main disciplines concerned is ecology, usually defined as a branch of biology that examines the interaction of organisms with their environment. The environment includes the physical factor – sunlight, temperature, water, and soil depth and texture – chemical factors – composition of the air, soil and substances dissolved in water – and biotic factors – other organisms.



**Figure 1.** The scheme of relationships in basic organisational levels<sup>1</sup>

The German zoologist Ernst Haeckel coined the word "ecology" in 1866. It is based on the Greek word "oikos," meaning house, or more loosely "habitat." Ecologists study the patterns of distribution and the abundance of organisms in nature, how these patterns are maintained in the present time and how they change over the course of evolution. The science of ecology grew out of the already established discipline of natural history – the observation and description of organisms in nature. In the 1960s, the study of ecology gained impetus with the

realisation that human activities have a profound effect upon the living world, and that this in turn affects us by altering our own environment.

With respect to this, it is of crucial importance to understand not only for the present time, but particularly for the future, the hierarchical organisation of life on Earth, from the simplest to the most complex biotic levels – molecules, cell organelles, cells, organisms, populations, species, communities, ecosystems, biomes, biosphere. This hierarchical system of life is organised as a system of dynamic equilibrium, where any change in any segment has an impact on the system as a whole, while any change in the whole system is transmitted to its every part (Figure 1).

### Significance of environmental education

In order to fully answer this question, one must comprehend the whole diversity of living matter, no easy task since there are many different estimates on the total number of recent species on Earth. Only around 1.5 million, more precisely 1,435,662 species,<sup>2</sup> are described and properly inventoried, but estimates on the total number of species vary from 10 to 100 million species.<sup>3</sup>

Concerning these facts, one of the most intriguing question arises: out of such a diversity, how can only one species be capable of threatening the whole biosphere? One of the theories explaining this phenomenon is that only those species that are able to quickly alter their resource consumption patterns pose destructive potentials,<sup>4</sup> and *Homo sapiens* is one of those, with its high adaptability and never-ending appetite for all biological resources.

When did this destructive human influence on the environment become substantially different compared to other species? The discovery of fire is thought to be the starting point of biosphere pollution. Another very important moment was the start of extensive coal usage in the 13th century, and the climax was reached in the second half of the 19th and the beginning of the 20th century, when humans started using oil and its derivatives for energy production. It is very hard to predict the long-term consequences of such activities undertaken not only in the past, but also in the present and future, particularly concerning the currently used time-scale.

Our activities are measured in tens and hundreds of years, but the history of the planet and the evolution of life are composed of events and processes that take millions or billions of years. There is a very illustrative example: if one could fit the period of existence of our planet to an average human lifetime, 100 million years would be equal to 1 year of a human life time. In the same scale the Earth would be 46 years old, bacteria would be 35 and the first unicellular eukaryotic life forms would be 15 years old. The dinosaurs would have suffered their extinction around 8 months ago and humans would have appeared only 7 days ago. The process of polluting and damaging the environment would have started 3 seconds ago. The question is: what are 3 seconds when compared to 46 years, bearing in mind that such a limited period of time might be enough for the destruction of humans and their civilisation, but probably not enough for the destruction of nature.

Nowadays, humans are the only species with the potential of starting an environmental disaster that cannot be compared to any other event that has occurred in evolution to date. Our attention should be focused on the problem of the extinction of organic species, because these alterations in the environment are completely irreversible. On the other hand, certain changes in the biosphere caused by humans can be overcome and the consequences reduced. It is important to stress that humans caused the extinction of many species long ago – for example, mammoths, moas and some other large animals. The commonly held view that the pre-industrial era was an era of golden ecological harmony is mostly false. Whole new dimensions to human destructiveness and its impact on the environment were created by the high level of population growth which began at the end of the 19th century. Human need for resources resulted not only in the extinction of some species, but in the destruction of whole biocoenoses and ecosystems. One estimate is that our planet and its diversity lose 27,000 species per year, or 74 species per day. The exhibited rate of extinction – around 100 species per day – is 1,000 times higher than the estimated "normal" evolutionary extinction rate. If we continue with our above-mentioned activities at the same rate, around 20% of all recent species could become extinct in the next 30 years.<sup>4</sup>

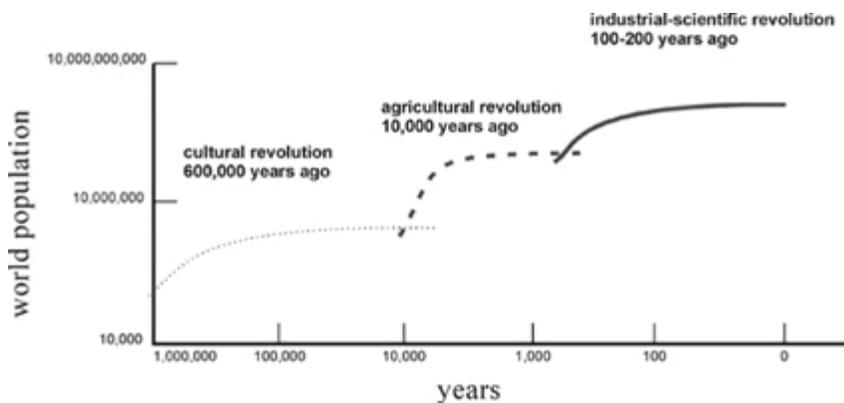


Figure 2. Human population growth figures; arrows indicate the beginning of each basic period.<sup>5</sup>

Extinction is a usual biological and evolutionary process, but in the years to come we are going to face mass and irreversible man-induced destruction of different life-forms at such a rate that we will have a global environmental problem in our hands. With respect to environmental education, the problem of the destruction of the environment and the extinction of species should be dealt with in a holistic way, meaning that the biodiversity on our planet is a far more complex phenomenon than a simple sum of all living creatures.

Why? Because ecological interactions and relations established in long-lasting evolutionary processes of different species represent the basis of the existing complexity, stability, diversity and functioning of ecosystems that are of crucial importance to the survival of *Homo sapiens*. Apart from species and ecosystem diversity, the complex term of biodiversity also encompasses the category of genetic diversity, or diversity on the gene level. The diversity of genetic information that is enclosed in the hereditary material of all species represents the basis for adaptive and evolutionary changes; without them, living organisms would not be able to survive in their environment.<sup>1</sup>

The results of demographic research on world population figures<sup>5,6</sup> exhibit a clear distinction of three basic periods in its growth: the first period – approximately 600,000 years ago – is described as the cultural revolution, and the second period – approximately 10,000 years ago – is described as the agricultural revolution. The last period started 200 years ago and is described as the science-industrial revolution<sup>7</sup> (Figure 2). It is also the one that we still live in, and is characterised by dramatic changes and an unexpected future.

Speech is the main "event" in the first period, in that it enhanced the exchange of information and ensured effective communicating of diverse knowledge and skills, usually concerning the environment and relations within it, to less experienced individuals in the community. This kind of knowledge has changed human behaviour and is directly related to the intensive growth of the human population. This could be recognised as the early beginning of environmental education.

Even more dramatic growth can be noticed during the second period with the introduction of agriculture, enabling storage of excessive products, directly influencing the rate of growth of the human population. Acquiring new skills necessary for effective land use and farming, factors belonging to the broad scope of applied ecology are viewed as essential for population growth. In addition, this period is characterised by human destructive influence on the environment, sometimes with fatal consequences for some civilisations – i.e., the Incas, Mayas, Sumerians, Romans.

If we focus our attention on this period we could conclude that environmental problems are not an exclusive characteristic of the modern age, and that these problems have something in common with the ones we are facing today. Both past and present are characterised by lack of knowledge and neglect of environmental processes, but on a different level – what was once a local level has recently become a global, planetary level.

The Sumerian civilisation, for example, used the waters of the Tigris and Euphrates for irrigation, thus causing salination of the agricultural land and leading to its total infertility. Likewise, one of the reasons for the decline of Roman civilisation can be found in the spread of swamp and marsh areas, the characteristic habitat of the malaria mosquito. Severe deforestation in the Mediterranean basin led to significant soil erosion, even in the Southern Balkans, directly influencing the civilisation of ancient Greece. The most recent theories concerning the decline of the Mayan civilisation argue that deforestation had a significant impact upon local climate changes. It is thought that the Mayas cut woods not only to create agricultural land, but also to obtain the building materials with which they constructed their fascinating sites.



**Figure 3.** Front page of Begon's textbook of ecology<sup>8</sup> and a pictorial presentation of a deer found on a rock in Lipci near Kotor (Boka Kotorska, Montenegro, Yugoslavia).

Two illustrations related to the period discussed are shown (Figure 3), exhibiting some components of environmental education. The first illustration is the front page of Begon's textbook of ecology<sup>8</sup> and the other is a pictorial presentation of a deer found on a rock in Lipci near Kotor – Boka Kotorska, Montenegro, Yugoslavia. According to archaeological and art history data, this pictorial presentation originates from the late Bronze age – around 3500 BC – and represents a ritual dedicated to the cults of hunting and the rising sun.<sup>9</sup> Our opinion is that these illustrations also represent the cult of surviving, encompassing some elements of environmental education and giving information about the nature and amount of food available to that particular community of *Homo sapiens* species.

The third period, that of the science-industrial revolution, is characterised by an extremely negative human influence on the natural environment, one that is very likely to result in fatal consequences for the global level, leaving us and our descendants with an uncertain future. Human influence on the environment in the past was of a local character, in contrast to the recent global changes and serious disturbances induced by human activity on a broader scale, meaning the global, planetary level.

If we consider the past thirty years and ask ourselves why environmental education is so important, we could say that it is directly related to the survival of the human species and human civilisation as a whole. The following phenomena have been attracting our attention during the past thirty years and, as such, should be the focus of any attempt at developing

an environmental education: (a) acid rain; (b) the destruction of the ozone layer; (c) the "greenhouse effect"; (d) loss of biodiversity; (e) loss of agricultural land; (f) deforestation; (g) accumulation of different toxic agents, including radio-nuclides; (h) pollution of the atmosphere; (i) pollution of surface and subterranean waters; (j) industrial hazards.

In the early 1960s, the above mentioned environmental problems were hardly focused upon, but in the 1970s most of these issues, as well as the terms associated with them, became catchphrases, receiving wide coverage throughout the world. At the beginning of the third millennium, probably all – and maybe some more – of these problems will become part of everyday life, almost colloquial topics of conversation in most parts of the world. It is only by bearing all of these facts in mind that we can understand why environmental and ecological education is so very important for the survival of humans.

The purpose of environmental education should be to create a citizenry that can help resolve environmental problems with the strategy of closely-knit social or individual activities. The knowledge and skills acquired through this particular type of training is of crucial importance for raising both individual and social awareness of environmental protection, as well as for developing a global action plan. These should be considered the most significant elements of educational programmes, from primary school to postgraduate level and beyond.<sup>10</sup>

### **Members and target groups for environmental education**

In the early 1970s, the emerging environmental education movement was given a powerful boost by the United Nations Conference on the Human Environment held in Stockholm in 1972, which recommended that environmental education be recognised and promoted in all countries. The International Workshop on Environmental Education, organised by UNESCO and held in Belgrade in 1975,<sup>11</sup> offered concepts and visions which were later adopted by governments in Tbilisi, at the Intergovernmental Conference on Environmental Education in 1977.

After these, the most important meetings relevant for environmental education were held in Jomtien in 1990, in Toronto in 1992, and in Istanbul in 1993. In addition, a series of UN conferences were held, beginning in 1992 with Rio – environment and development – and followed by Cairo 1994 – population – Copenhagen 1995 – social development – Beijing 1995 – women – Istanbul 1996 – human settlements – and Amman 1996.

Two prominent meetings took place in 1997: the Global Conference on Environmental Education in New Delhi,<sup>12</sup> and the International Conference on Environment and Society, Education and Public Awareness for Sustainability in Thessaloniki.<sup>13</sup>

The Global Conference on Environmental Education, held in August in New Delhi, addressed the following topics in particular: natural resources and their management; environmental education for sustainable development; peoples' participation and the role of NGOs; cleaner technologies, waste management; population, urban environment and sanitation; environmental ethics and legislation; the effects of environmental pollution on health; country status reports; women, children and environment.

The International Conference on Environment and Society, held in Thessaloniki, was also an event of major international importance. The Conference was jointly organised by UNESCO and the Greek Government, with generous support from the Greek Ministry for the Environment, Urban Planning and Public Works, as well as the Ministry of National Education and Religious Affairs, the Ministry of Culture, the Ministry of Foreign Affairs, the General Secretariat for Youth and the Organisation for the Cultural Capital of Europe-Thessaloniki '97. Its purpose was to bring education and public awareness to the International Community on the eve of the third millennium. It has become clear that we need appropriate education and awareness in order to pave the way for society to live in a peaceful and sustainable way, with a care for the natural and cultural environment. A society keen and willing to address the pressing issues of the present in innovative and efficient ways, a society which will allow future generations to adequately address their own needs, too.

Although the conference was organised during a very difficult period – at the same time as the Kyoto meeting and other major events – it succeeded in accomplishing all its major aims in "record" time. More than 1,000 people representing governmental and intergovernmental institutions, along with educators from all backgrounds, participated actively and were given the opportunity to inform and be informed on a lot of interesting and innovative projects. They were also able to hear and discuss, formally and informally, about principles, actions and projects during the various sessions. As the UNESCO Director General, Dr. Federico Mayor, acknowledged during his speech, the conference was of major international importance, and was proclaimed the legitimate follow-up in the area of Education for the Environment and Sustainability to the major Conferences of Tbilisi 1977, Moscow 1987 and Rio de Janeiro 1992.

Most of the findings of the conference, which saw participation from governmental, intergovernmental, non-governmental organisations (NGOs) and visitors from 83 countries, are elaborately presented in the unanimously adopted Conference Declaration. Article 9, which deals with the general need for an environmental education for all, is emphasised: "Education is an indispensable means to give to all women and men in the world the capacity to own their own lives, to exercise personal choice and responsibility, to learn throughout life without frontiers, be they geographical, political, cultural, religious, linguistic or gender."<sup>13</sup>

In April 1998, the UNESCO Conference on Education for the 21st Century in the Asia-Pacific Region was held in Melbourne. The common idea of all of these meetings is that ecological education is a means for all, regardless of gender, nation or religion.

### **How should environmental education be organised?**

It is very important to stress the fact that the first textbook on ecology in Yugoslavia was published in 1933 by Professor Sinisa Stankovic, the Founder of the Belgrade School of Ecology, under the title *The Frame of Life*. The fact that makes this book exceptional is that *The Frame of Life* was published only 7 years after Elton's *Animal Ecology* (1927),<sup>14</sup> the first book with a title that includes the term "ecology."

Shortly after that, S. Stankovic published a secondary school textbook on zoology with large portions on ecology.<sup>7,15</sup> Ecology was fully introduced into the system of higher education in 1946, and the first recipient was the University of Belgrade, which inaugurated separate courses on animal and plant ecology. From that period up to now, courses dealing with these matters have been constantly improved and fully updated.

Bearing in mind the extremely complex current human impact – as a specific ecological factor – on the biosphere, with all its positive and negative effects and consequences at global, regional and local levels, as well as the concern of contemporary man for his survival – defined as a global concept in *Global Survival Strategy and Concern for the World: A Strategy for Survival*, the Department of Biology at the University of Belgrade, following the proposal of the Chair of Plant Ecology and Phytogeography and the Chair of Animal Ecology and Zoogeography, initiated, in 1997, a new B.Sc. degree programme in ecology and environmental sciences. This programme has a multidisciplinary approach to all problems concerning environmental protection, which means that a wide range of subjects – courses in geography, hydrology, pedology, geology, meteorology, technology, sociology – are integrated in the programme (Table 1). Emphasis is given to biological aspects that represent the basis for all research in ecology and environmental sciences. We intend to educate ecologists who will be able – in multidisciplinary teams, in co-operation with technocrats, urbanists, architects, agronomists, sociologists, lawyers, economists and others – to contribute to the solution of many environmental protection problems.<sup>16</sup>

### Biological resources and biodiversity in Yugoslavia

One of the primary goals of ecological education is to improve the recognition of biological resources and biodiversity – recognition of their value and of their need for protection. Biological resources – genes, species and ecosystems that have actual or potential value to people – are the physical manifestation of global biological diversity, which may be defined as the variety and variability of living organisms and of the ecological complexes in which they occur.

Biological diversity comprises all species of plants, animals and micro-organisms and the ecosystems and ecological processes of which they are part. It is usually recognised at three levels: genetic diversity, species diversity and ecosystem diversity. Genetic diversity is the sum total of genetic information, contained in the genes of all individual living organisms. Species diversity refers to the variety of living organisms on Earth and has been estimated to be between 5 and 100 million, though only about 1.5 million have actually been identified. Ecosystem diversity relates to the variety of habitats, biotic communities, and ecological processes in the biosphere.

The most recent analyses of flora and fauna populations in the Federal Republic of Yugoslavia – Serbia and Montenegro – exhibit that they are amongst the richest in Europe. The abundance and diversity of taxa, ecosystems and landscapes may be explained by various climatic, geomorphologic, petrographic, orographic and hydrographic features, as well as by a great number of refugial habitats throughout the land, where a significant number of relic and endemo-relic species and communities – dating back as far as the Tertiary and Ice Age – has been preserved.

In biogeographical terms, almost all basic chorions of Europe are present within the territory of Yugoslavia – steppe zonobiome, zonobiome of deciduous forests, orobiome of Mediterranean forests and shrubs, orobiome of coniferous boreal forests, orobiome of high-mountain tundra, and the Adriatic sea as a part of the complex marine biome. They are represented by specific provinces and districts characterised by endemites of different taxonomic rank.

**Table 1.** Curriculum of the B.Sc. degree in Ecology and Environmental Sciences

Course	Semester and Weekly hours								
	1	2	3	4	5	6	7	8	9
	28	25	28	27	27	30	26	30	30
1. Botany I	8	8							
2. General and Comparative Zoology	8	9							
3. Physical Chemistry	4								
4. Biochemistry		4							

5. Biostatistics	4	4							
6. English Language	4								
7. Botany II			4	4					
8. Systematics and Phylogeny of Animals			4	7					
9. Fundls. of Genetics & Genotoxicology			4	4					
10. Microbiology and Microbial Ecology			4	4					
11. Physical Geography			4	4					
12. Geology with Mineral Resources			4						
13. Climatology with Meteorology			4						
14. Fundamentals of Ecology				4	2				
15. Animal Physiology & Ecophysiology					3	4			
16. Plant Physiology & Physiol. Ecology					6				
17. Air Pollution and Air Protection					4				
18. Pedology, Pedobiology, Soil Protect.					4	4			
19. Technological aspects of Environmental Protection					4	3			
20. Aquatic Ecology, Fresh Water Protection					4	4			
21. Marine Ecology						4			
22. Theory of Organic Evolution						3			
23. Plant Ecology						4	4		
24. Animal Ecology						4	4		
25. Human Ecology with Urban Ecology							4		
26. Medical aspects of Envir. Protection							4		
27. Legislative aspects of Environmental Protection							2		
28. Monitoring Systems & Bioindicators							4	4	
29. Biogeography							4	4	

30. Ecosystem Advancement								4	
31. Ecological Aspects of Urban Planning								4	
* Fieldwork (with 23, 24, 28, 29, 30)								14	
32. Biodiversity Protection								4	
33. Applied Ecology								4	
34. Optional course								4	
35. Final paper								18	

**Optional Courses:** 1) Systems Ecology, 2) Radiation Ecology, 3) Biospeleology, 4) Ecological Management, 5) Social Ecology, 6) Pedagogy

This great biodiversity of the territory of Yugoslavia, that represents one of the 153 centres of biodiversity in the world and which is one of the six centres of European biodiversity, is characterised not only by rather heterogeneous florogenetic and faunogenetic composition and mosaic distribution, and the great spatial density of its components – species, ecosystems and landscapes – but also by over 1600 internationally significant species, including a great number of local endemites, as well as their habitat preferences – in accordance with the CORINE classification.

The numerical synopsis of some animal and plant taxa diversity in the territory of the Federal Republic of Yugoslavia is shown in Table 2.

#### Environmental education in the future – development and sustainability

Moving towards the goal of sustainability requires fundamental changes in human attitudes and behaviour. Progress in this direction is thus critically dependent on education and public awareness. The concept of sustainable development – as this document suggests – is not a simple one, and there is no roadmap to prescribe how we should proceed. Yet time is short, and we are called upon to act without delay. We must move ahead now, in a spirit of exploration and experimentation and with the broadest possible range of partners, so as to contribute through education to correcting trends that place our common future in jeopardy. In 1994, UNESCO launched an international "Educating for a Sustainable Future" initiative – known as the EPD Project – to serve as a stimulus for trans-disciplinary reflection and action.

It is widely agreed upon that education is the most effective means that society possesses for confronting the challenges of the future. Indeed, education will shape the world of tomorrow. Progress increasingly depends upon the products of educated minds: upon research, invention, innovation and adaptation. Of course, educated minds and instincts are needed not only in laboratories and research institutes, but also in every walk of life. Indeed, access to education is a *sine qua non* for the effective participation in life of the modern world at all levels.

Education, to be certain, is not the whole answer to every problem. But education, in the broadest sense, must be a vital part of all efforts to imagine and create new relations among people, and to foster greater respect for the needs of the environment. Education must not be equated with schooling and formal education alone. It includes non-formal and informal modes of instruction and learning as well, including traditional learning acquired in the home and in the community.

By defining education broadly, one also widens the community of educators – as the programme statement of Education 21 promoted within the UK notes – to include "teachers, lecturers, curriculum developers, administrators, support staff, industrial trainers, countryside rangers and staff, environmental health and planning officers, education officers with NGOs, community educators, youth leaders, parent association members, media people, representatives of learners in all contexts, and yet more."

**Table 2.** Synopsis of Yugoslav biodiversity<sup>17</sup>

	Europe	Yugoslavia	%YU/EUR	YU	YU
	4,900,000 km <sup>2</sup>	102,181 km <sup>2</sup>	2.1%		
<b>Taxa</b>				Introduced	Endemic

Fungi Macromycetes	6,500	650	10.00%	73	
Bryophyta	1,500	565	37.67%	7	7
Vascular Plants	11,000	4,282	38.93%	329	87
Cladocera	140	91	65.00%	4	4
Copepoda	500	72	14.40%	1	1
Opiliones	310	66	21.29%	20	18
Insecta					
-Collembola	750	228	30.40%		4
-Odonata	127	56	44.09%	1	
-Orthoptera	600	192	32.00%	21	18
-Plecoptera	387	72	18.60%		
-Heteroptera	2,800	700	25.00%	2	2
-Thysanoptera	500	89	17.80%		
-Neuroptera	230	87	37.83%	6	
-Coleoptera	9,000	6,000	66.67%	272	246
-Lepidoptera	8,000	1,440	51.16%	19	
-Rhopalocera	300	200	66.67%		
Pisces Osteichthyes	215	110		23	3
Amphibia	74	26	35.14%	18	6
Reptilia	203	44	21.67%	34	8
Aves	516	382	74.03%	326	
Mammalia	142	96	67.61%	23	
Other taxa				421	

Most people in the world today have an immediate and intuitive sense of the urgent need to build a sustainable future. They may not be able to provide a precise definition of

"sustainable development" or "sustainability" – indeed, even experts debate that issue – but they clearly sense the danger and the need for informed action. They smell the problem in the air they breathe, they taste it in their water, they see it in more congested living spaces and blemished landscapes, they read about it in the newspapers and hear about it on radio and television.

The stories that carry the message may be about pollution alerts or the bans on driving and closed beaches that result from them, or about hunger and famine, growing health problems such as asthma and allergies, unsafe drinking water, greenhouse gases and the threat of global warming and rising ocean levels, the destruction of the world's forests and the expansion of deserts, the disappearance of species, the large-scale death of fish and birds caused by oil spills and pollution, or about forest fires, floods, dust storms, draughts and other so-called natural disasters. Or they may be about many other matters suggesting increasing levels of distress and desperation: inexplicable violence and outbreaks of war, mass migrations, the rise of intolerance and racism, the denial of democratic freedoms, corrupt practices that enrich the few at the expense of the many, rising prices and resource scarcities, growing unemployment and slipping standards of living for many of the world's inhabitants.

Development itself – what it means and how it is measured – is also an important part of the problem. Standard measures of development, such as gross national product, equate development with growth in production and consumption of goods and services. While such measures take into account investment in the means of production, such as the excavation of copper mines or the drilling of oil wells, they fail to account for the use and eventual exhaustion of the precious capital represented by the world's endowment of natural resources. Nor, until quite recently, have economists adequately recognised that the capabilities embodied in women and men through education, experience and training are, in fact, the most essential "means of production."

Yet, perhaps the greatest problem arises from the automatic equation of higher levels of production – and by implication, of consumption – with development. Economists, and everyone else as well, recognise that this is at best a half-truth. What is produced, and especially what the product is used for, is every bit as important as how much of it is turned out. An added dollar of consumption, which doubles the daily income of an impoverished individual, evidently serves a very different purpose than the negligible addition of a dollar of purchasing power to the income of a millionaire. Yet, the automatic equation of a single technical measure of development, usually GNP, with society's overall progress and well-being is pervasive. It is part of an overall 20th century mind-set which believes that means are more important than ends, and that levels of activity are more important than the purposes served.

Sustainable development has been variously defined and described. It is not a fixed notion, but rather a process of change in the relationships between social, economic and natural systems and processes. The World Commission on Environment and Development, for example, defined sustainable development in terms of the present and the future: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Other definitions have extended the notion of equity between the present and the future, to equity between countries and continents, races and classes, genders and ages.

**Table 3.** Work Programme of the CSD

<b>Education, Public Awareness and Training</b>	
<b>Priorities agreed upon by the CSD</b>	<b>Key actors cited by the CSD</b>
A. Develop a broad international alliance, taking into account past experience and promoting networks	UNESCO as task manager, in partnership with UNEP, IUCN and other key institutions
B. Integrate implementation of recommendations concerning education, public awareness and training in the action plans of the major UN conferences and conventions	UN system, governments, major groups
C. Advise on how education and training can be integrated into national educational policies	UNESCO, in co-operation with other governmental and non governmental organisations
D. Refine the concept and key messages of education for sustainable development	UNESCO
E. Advance education and training at the national level	Governments, with assistance from the UN system and others
F. Provide financial and technical support	Developed countries, international organisations, private sector

G. Develop new partnership agreements among different sectors of society. Exploit the new communication technologies. Take into account cultural diversity.	Educators, scientists, governments, NGOs, business and industry, youth, the media, other major groups
H. Work in partnership with youth	Governments and other relevant stakeholders
I. Analyse current investments in education	Bretton Woods institutions
J. Take preliminary results of the work programme in Agenda 21's Chapter 36 into account in the 1997 review	Secretary-General of the United Nations
K. Make relevant linkages with the CSD programme of work on changing production and consumption patterns	UN system, governments, NGOs

Perhaps the most widely used definitions focus on the relationship between social development and economic opportunity, on the one hand, and the requirements of the environment on the other: i.e., on improving the quality of life for all, especially of the poor and deprived, within the carrying capacity of supporting ecosystems.

Sustainability, in effect, involves an equation of environmental requirements and development needs. It can be balanced by acting either to reduce the strain on the environment or to increase its "carrying capacity." The argument between ecologists and economists has been that ecologists stress the former course of action while economists stress the latter. It is evident that in a crisis, both possibilities have to be carefully explored. There are environmental strains, such as population booms, that at some point become incompatible with both the maintenance of the environment and the quality of life. By the year 2030, for example, it is projected that there will be three billion more people on Earth than today. The task of feeding, clothing and sheltering them will be enormous, and that of providing them with education, employment, security and a minimum of well-being and satisfaction even greater. These facts of life must not be ignored. But neither should the capacity of humanity to find and invent solutions be overlooked or minimised.

The summary of the decision of the 4th session of the UN Commission on Sustainable Development – New York, May 1996 – concerning Chapter 36 of Agenda 21 – prepared by UNESCO as Task Manager – is shown in Table 3, followed by the extract from the Report of the 19th Special Session of the General Assembly of the United Nations, Earth Summit +5, June 1997.

### **Earth Summit +5: overall review and appraisal of the implementation of Agenda 21**

#### *Chapter 36: Promoting Education, Public Awareness and Training*

- Education increases human welfare, and is a decisive factor in enabling people to become productive and responsible members of society.
- A fundamental prerequisite for sustainable development is an adequately financed and effective educational system at all levels, particularly the primary and secondary levels, that is accessible to all and that augments both human capacity and well-being.
- The core themes of education for sustainability include lifelong learning, interdisciplinary education, partnership, multicultural education and empowerment.
- Priority should be given to ensuring women full and equal access to all levels of education and training. Special attention should also be paid to the training of teachers, youth leaders and other educators. Educators should also be seen as a means of empowering youth and vulnerable marginal groups, including those in rural areas, through intergenerational partnership and peer education.
- Even in countries with strong education systems, there is a need to reorient education, awareness and training so as to promote widespread public understanding, critical analysis and support for sustainable development.
- Education for a sustainable future should engage a wide spectrum of institutions and sectors, including, but not limited to, business/industry, international organisations, youth, professional organisations, non-governmental organisations, higher education, government, educators and foundations, to address the concepts and issues of sustainable development, as embodied throughout Agenda 21.
- [Education for a sustainable future] should also include preparation of sustainable development education plans and programmes, as emphasised in the Commission's work programme on the subject adopted in 1996.
- The concept of education for a sustainable future will be further developed by the United Nations Educational, Scientific and Cultural Organisation, in co-operation with others.
- It is necessary to support and strengthen universities and other academic centres in promoting co-operation among them, particularly co-operation between those of developing countries and those of developed countries.

### The biocentric approach

A distinct new approach in environmental protection problems has been recently proposed by the Biopolitics International Organisation (B.I.O.). This approach represents the shift from an anthropocentric to a biocentric system of values, and it is best presented by the words of its Founder and President, Dr. Agni Vlavianos-Arvanitis:

"Immediate action is of the essence. By the time reforms and revisions are approved, they tend to be already outdated. Loss of biodiversity, destruction, war, exploitation of the poor, unequal distribution of resources and trade methods that increase the depth of developing nations require a prompt and radical solution. This solution has to be encouraged by expanding the potential of human resources and channelling them towards a productive and constructive renaissance. Long-term objectives for the implementation of global policies, such as fostering peace, developing human resources, curbing financial inequality and promoting strategies for eliminating world disparities have to become number one priority in the 21st century. The Biopolitics International Organisation has been labouring to raise awareness of the urgent need to instate a new system of economic norms and principles, compatible with sound environmental management and with the most important task of ensuring unbiased international trade and long term international investment. The goal is to eliminate current inadequacies in financial trends and guarantee economic prosperity for every country in the world. Moreover, the goal is to ultimately render the concept of a 'third world' obsolete and, through enhanced communication, trade and co-operation reach a desired state of world equilibrium in both economic and sociological terms. Guaranteeing a better quality of life for every citizen in the world holds the key to a harmonious and peaceful global society in the next millennium."<sup>18</sup>

Regarding the future of environmental education, it is important to understand the basic relationships between natural, economic and social systems, which are easier to recognise when presented schematically (Figure 4). For the successful future of both humankind and nature, sustainability must be maintained through the balanced contribution of all three circles.<sup>19</sup> This will become possible through an adequate global policy which recognises and promotes biocentric values for the next millennium: the policy of the B.I.O.

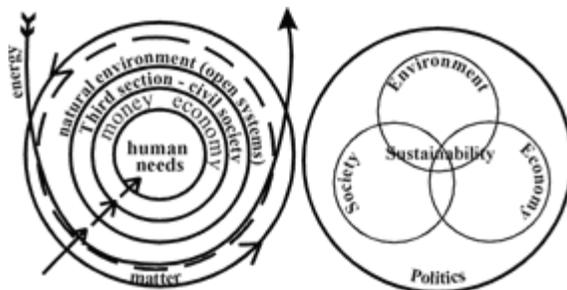


Figure 4. The basic relationships between natural, economic and social systems.

### Acknowledgements

This paper is an extended version of a communication presented at the "Days of Biopolitics and Bio-culture in St. Petersburg," held 12-15 January 1998. The original version was presented during the workshop on bio-environmental principles, under the "Biocentric Values for the Next Millennium" initiative. It is a great pleasure and honour to have been one of the participants of this B.I.O. meeting, and to feel a member of the "Bios family."

### References

1. Peyton B. et al. (1995) *Biological diversity. Environmental education module*. UNESCO-UNEP, pp. 1-152
2. McNeely J.A., Miller K.R., Reid W.V., Mittermeier R.A. and Werner T.B. (1990) *Conserving the world's biological diversity*. IUCN, Gland, Switzerland, WRI, CI, WWF-US, and the World Bank, Washington DC
3. Pimm S.G.J., Russell S.L. and Brooks T.M. (1995) The future of biodiversity. *Science* 269:347-350
4. Wilson E.O. (1992) *The diversity of life*. Harvard University Press, 424 pp.
5. Deevey E.S. (1960) The human population. *Sci. Amer.* (209)9
6. Savic I. (1985). Istorija demografskog razvitka svetskog stanovništva. *Savremena biologija* (Beograd) (16)1:5-9
7. Radovic I. (1996) *Ekolosko obrazovanje i zastita zivotne sredine*. V kongres ekologe Jugoslavije. Plenarni referati. Beograd, pp. 77-94
8. Begon M., Harper J. and Townsend C.R. (1996) *Ecology: individuals, populations and communities*. Third Edition. Blackwell Science, Oxford
9. Lukovic N. (1970) *Skulptura i slikarstvo U. Kotor*. In: D. Kalezic (ed) Graficki zavod hrvatske. Zagreb, pp. 97-104
10. Skanaris C. (1993) *Environmental education for survival*. Bulletin of the Ecological Society of America (74)1:66-67
11. The International Environmental Education Programme – UNESCO – UNEP (1975) *The International Workshop of Environmental Education*. 12-22 October, Belgrade
12. Global Conference on Environmental Education (1997) *Book of abstracts with Annex-1 (Conference Document)*. August 18-22, New Delhi, India

13. UNESCO (1997) *Education for a sustainable future: a transdisciplinary vision for concerted action*. International Conference: Environment and Society: Education and Public Awareness for Sustainability. Thessaloniki, 8-12 December
14. Elton C. (1927) *Animal ecology*. Sidgwick & Jackson, London
15. Savic I.R. (1984) *Stanje i perspektive ekoloskog obrazovanja i vaspitanja u SR Srbiji*. III kongres ekologa Jugoslavije. Plenarni referati i koreferati, Sarajevo pp. 39-60 (Bilten Društva ekologa BiH, B4, Sarajevo, 1985, pp. 65-73)
16. Savic I., Stevanovic V., Radovic I., Stevanovic B., Jovanovic S., Stamenkovic S., Lakusic D. and Cetkovic A. (1995) *A new programme for the B.Sc. degree in ecology and environmental sciences at the Department of Biology, University of Belgrade*. EURECO 95. 7th European Ecological Congress. Abstracts, W2, 260. Budapest
17. Stevanovic V. and Vasic V. (eds) (1995) *Biodiverzitet Jugoslavije sa pregledom vrsta od medjunarodnog znacaja*. Bioloski fakultet i Ecolibri, Beograd
18. Vlavianos-Arvanitis A. (1997) Biopolitics – the bio-environment – biocentric values as a challenge for the next millennium. *The Environment* (Belgrade) (1)1-2:30-40
19. Savic I. and Radovic I. (1998) *Ekoloska edukacija u funkciji održivog razvoja. Osnove za pripremu strategije ekoloske edukacije u funkciji održivog razvoja u SR Jugoslaviji*. (Elaborat 1-30+III) Savezno ministarstvo za razvoj, nauku i životnu sredinu. Beograd

---

**Professor Ivica T. Radovic** is Associate Professor of General Biology and Principles of Ecology at the Institute of Zoology, Faculty of Biology, University of Belgrade. He received a Ph.D. in entomology from the University of Belgrade in 1981, and was trained in the taxonomy of Hymenoptera at the National Museum of Natural History in Prague, Czech Republic, and the Smithsonian Institute in Washington DC, USA. He also studied at the Zoological Institute of the University of Copenhagen, Denmark. In 1982, he became Assistant Professor of Entomology and Principles of Systematic Zoology at the University of Belgrade and, in 1991, he obtained his current position. Professor Radovic is Member of the Entomological Society of Serbia, the Biological Society of Serbia, the Entomological Society of Washington, the International Society of Hymenopterists and the Serbian Ecological Society. He has authored several scientific publications, as well as textbooks and teaching manuals.